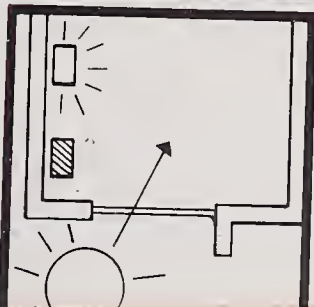


A11105 968457

Reference

NBS
Publi-
cations

ITS



Interior
Mass

masonry, concrete,
stone, water

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10.575
1470

EXAMPLES

A. Air Tightness

B. Water Tightness

Water container
items critical.
See "M"
OW

QC

100

.U57

No. 575

1980

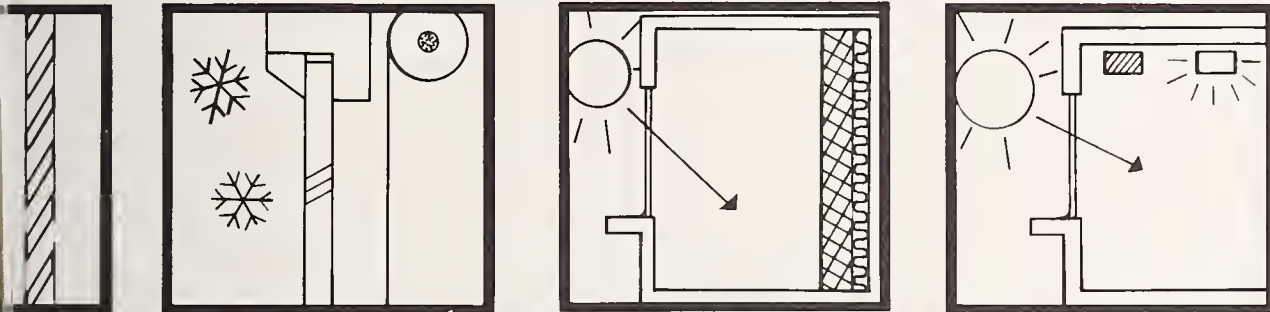
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1980

Reference

NBS
Publi-
cations



INTERIOR DESIGN ELEMENTS



14. Interior Coverings

Roll shades, inside storm sash, heavy drapery, shutters

15. Integrated Lighting

Fixture circuiting, task lighting, light-sensing automatic controls

16. Interior Mass

Masonry, concrete, stone, water

Solid weather-stripped shutters improve air-tightness

Water container seams critical. Also see "M" below

A. Air Tightness

B. Water Tightness

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EXAMPLES

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DESIGN FOR BETTER WINDOW PERFORMANCE



U.S. DEPARTMENT OF
COMMERCE
Philip M. Klutznick,
Secretary
Luther H. Hodges, Jr.,
Deputy Secretary
Jordan J. Baruch,
Assistant Secretary for
Productivity, Technology
and Innovation

NATIONAL BUREAU OF
STANDARDS
Ernest Ambler, Director

EXAMPLES

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EXAMPLES

EXTERIOR DESIGN ELEMENTS				FRAME DESIGN ELEMENTS				GLAZING DESIGN ELEMENTS				INTERIOR DESIGN ELEMENTS																														
1. Landscaping Shade trees and windbreaks consisting of hedges, tree lines, fences	2. Shades Sun screens, louvers, awnings, architectural projections	3. Coverings Roll blinds, shutters, storm sash	4. Sun Orientation South-facing windows	5. Insulated Frames Wood or metal with a thermal break	6. Opening Type Casement, awning, double-hung, sliding, jalousie, pivoting and hopper	7. Weatherstrip Pile, vinyl, foam, brass, or copper	8. Hardware Latches, operating devices, locks, and hinges	9. Multi Glazing Fused-edge or organically sealed insulating glass	10. Reflective Glazing Reflective coated glass or films	11. Plastic Glazing Polycarbonate (PC) or acrylic (AC) sheet	12. Glass Block Hollow masonry units of glass	13. Interior Shading Venetian or vertical blinds, open-weave drapery	14. Interior Coverings Roll shades, inside storm sash, heavy drapery, shutters	15. Integrated Lighting Fixture circuiting, task lighting, light-sensing automatic controls	16. Interior Mass Masonry, concrete, stone, water																											
A. Air Tightness	Reduced potential for water or air leakage to extent that windbreak shields the window, reducing wind and water velocity			Reduced potential for water or air leakage to the extent the device shields the window. Provide positive drainage for trapped water. Lack of drainage and freezing can increase air and water leakage			May or may not coincide with optimum orientation for summer prevailing breezes vs. winter wind. Correct conflicting orientation requirements by using other design elements such as wind screens or planting			Are as important as insulating value. Performance varies greatly with quality of window and type of operation. Hinged windows tend to be more airtight than vert. or horiz. sliding units. Excellent to minimum performance: 0.1 to 0.5 cfm per crack foot at 26 mph wind. ASTM e283-73 test. Note: Specify mfg's production average. Provide positive drainage and keep weeps clear. Hopper, awning or jalousie provide some rain protection when open. ASTM E-331 water penetration test used for evaluation			Since tightness degrades with use, ease of replacement essential. Pile type w/fin desirable for sliding units; use compression or spring type for hinged units			By cam action hardware can force tight closure of sash. Improper design can twist frame causing increased air and water infiltration																										
B. Water Tightness	A windbreak may alter summer wind direction and increase or decrease local velocity			May impede natural ventilation. Even insect screen reduces air flow by 50%			Direction and axis of opening directs air flow. Openable free area critical			May limit how window opens thus affecting quantity and quality of ventilation			Negligible			Solid weather-stripped shutters improve air-tightness																										
C. Natural Ventilation	A windbreak may alter summer wind direction and increase or decrease local velocity			May impede natural ventilation. Even insect screen reduces air flow by 50%									Operable vents available same size as block module			Concurrent shading and ventilation desirable			Closed mode may preclude natural ventilation			Mass cooled by night air can provide daytime cooling																				
D. Insulation	Windbreaks and shades will reduce rate of erosion of insulating layer of air at surface of glass to extent window is shielded from wind			Dead air space between covering and window insulates. More airtight coverings better			Sol-air temperature useful concept. See ASHRAE Handbook of Fundamentals. Locate spaces to receive winter sun during time of occupancy			Should be specified with multiple glazing in moderate and severe climates						Single glass U-value: (winter) = 1.10 btu/ft ² h°F Storm = 0.5 Double = 0.6 (½" space) I.R. refl. = 0.7 Sol. refl. = 0.9 Polycarbonate or acrylic = 1.06 12" sq. face 1 cavity = 0.52 2 cavity = 0.44			Minimal if free movement of room air between device and window			Depends on air-tightness of covering and tightness of edge fit			Daytime heat loss reduced because mass absorbs heat, reducing over-heating of space																	
E. Solar Admittance	Trees and tall hedges can reduce insulation			Ventilate space between window and shade at top and bottom. Remove or adjust to admit winter sun			Reduced solar gain according to shading coefficient. Adjust to admit winter sun			Excessive widths of sash and frame members reduce solar gain. Use net glazing areas for calculations						½" glass: shading coeff. (sc) = 1.0, % sol transmission (sol) = 87 (⅛ + ⅛) clear: sc = 0.89, % sol = 69 Low example: sc = 0.38, % sol = 17 High example: sc = 0.65, % sol = 60			Shading coeff ½" gl = 1.0 Ven. Blind = 0.6* Open weave curtains = 0.8* *Closed			Solar heat absorbed by mass permits greater glass area, w/o overheating																				
F. Daylighting	Landscaping elements may block daylight if in overgrown condition			If overdone, shading can necessitate expensive electric lighting. Ideally, device should reflect light to ceiling for maximum depth of daylight penetration into room			Intensive solar exposure for winter heating may cause glare. Provide control using design elements			Frame interior faces should be a light color to reduce contrast glare. Position window head near ceiling for maximum room depth of daylight penetration						½" glass: % visible transmission (vis) = 90 % vis = 81 Low example % vis = 15 % vis = 92 AC = 88 PC High example % vis = 75			Experimental reflective Venetian blind. Contact: 1 Oak Ridge Lab 2 Lawrence Berkeley Lab			Can be effective for complete black-out			Daylight sensing control operation on/off or continuous dimming			Dark color for solar absorption reduces room daylighting														
G. Visual Separation	Opportunity to provide privacy as desired			Some types as seen from outside are opaque during day but transparent at night												Tend to distort color rendition of view and correct sense of time			Scratches can detract from quality of view out			View out/in distorted or entirely obscured depending on type			See exterior shading and coverings			"Mass" walls can provide complete visual separation and passive solar heat														
H. Acoustical Isolation	Principal benefit is psychological. Provides minimal actual sound isolation			Decreases as distance of noise increases. Overhangs can reflect noise to the window			Can be effective if airtight and materials not same thickness or density			Airtightness critical to "sound tightness"						½" single glass sound transmission loss (db) = 24 ½" cavity = 32 6" cavity = 40 ¼" thick = 29 AC = 31 PC Stand blk = 38 Solid blk = 45			Negligible			Depends on air-tightness as in "D" above			No lighting system hum with daylight			Mass provides the best acoustical isolation if no penetrations														
I. Safety	Could alter circulation patterns to keep people away from windows			Projections within 7 ft. of grade may be hazardous to pedestrians			Can reduce trequency or severity of breakage-related accidents			Windows projecting in or out can be hazardous depending on location			Should not require excessive force to open or close window			Can limit opening dimensions to prevent children from falling out			Insulating glass eliminates hazard of installing/removing storm sash			May cause disorienting glare to pedestrians/drivers			Reduced probability of breakage-related accidents			May help prevent direct contact with glass in impact situations			Check allowable floor loading, caution in disposal of toxic additives											
J. Access/Egress	Must be located so as not to block emergency access or egress			Must be easily removable from inside for emergency exiting through windows used for egress. Must not reduce area or dimension below minimum required						Must not interfere with easy exiting			Typical exit window: 5.7 sq. ft. min. area, 21" min. dimension, 44" max. sill height			Should not inhibit the easy opening of windows used for emergency egress			Should facilitate rapid opening for emergency egress			Greater hazard to enter/exit through broken-out window			Avoid creating reflections that could confuse emergency exiting			Pop out gasketing may be desirable for egress through fixed units			Essentially impenetrable for emergency egress			Should not hide windows, and thereby reduce the likelihood of their use for emergency egress, nor impede any quick-opening qualities								
K. Ease Of Operation	Accumulated organic debris may reduce ease of operation			Interior operation of exterior devices desirable to meet changing exterior conditions or interior requirements						Must resist forces of operation and prevent binding of sash			Height affects ease of operation of different window types			See "I" above			Gear reduction or leverage can increase ease of operation			Increased weight makes operation more difficult due to inertia, friction			Requires no management by the occupant			Decreased weight makes operation easier			Due to easy accessibility interior coverings are more likely to be used			No occupant operation required with automatic controls			No operation required					
L. Forced Entry Resistance	May provide cover for intruders or act as partial barrier			May deter intruders depending on ease of removal or noise from breakage. Locked shutters or roll blinds very effective						Rigidity of frame and sash important to resist prying			No exposed removable hinges. Sash or glass should be removable from inside only			Soft weather-stripping can permit insertion of wire to unlock window			Function, quality placement, and anchorage critical to security			See "J" above			Impedes outside daytime surveillance			½" glass breaks when ¼ lb. steel ball dropped on a 12" sq Sample at height of 24" AC = 72" to 1000" PC = 1000"			Stand blk = 200" Solid = marred at 320"			Can prevent burglar's surveillance of interior			Can discourage penetration if locked closed			Can be integrated with security system to turn on lights upon intrusion		
M. Durability/Maintenance	Require pruning, feeding, watering (plants), painting (fences)			Must withstand wind, rain, ice, and intense solar radiation. May require seasonal removal. Some are self storing—e.g., roller awnings. Detail installation to avoid staining adjacent materials			Avoid use of materials whose appearance is diminished by fading			Thermal break material must be UV stable or protected from sunlight			The more movable parts the greater the possible need for maintenance			Must be detailed to permit periodic replacement			Simple is beautiful and makes economic sense			Durability of edge seal of insulating glazing critical			Scratch resistance important. Caution in cleaning			Easily scratched. May increase frequency of replacement			Very durable but if damaged, replacement difficult			The need for periodic cleaning makes ease of removal desirable			Daylight use increases lamp life if switching infrequent			Water may require antifreeze, rust inhibitor, or algicide		

